

Paper

# The evolution of sites of surgery

J Hedley-Whyte, DR Milamed

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## SUMMARY

**The shift to ambulatory surgery has taken decades. The history and causation of the move are complex. Key enablers are recounted. The complex interchange of ideas, and physicians, between Belfast and Boston was important in the development of relevant facilitating standards. US and UK governmental and hospital statistics in the increase of ambulatory surgery are presented. The transition of surgery away from hospitals was not all plain-sailing. Insurance companies, governments and hospital administrators hindered and then acquiesced. The shift to ambulatory surgery has not resulted in increased patient morbidity and mortality.**

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## INTRODUCTION

Five cities, Belfast, Boston, Los Angeles, Phoenix, and Washington, DC have been the sites of major successful efforts to change the vast majority of surgery and anaesthesia from requiring the patient's use of hospital beds (*Fig. 1*). The enabling causes are political, including patient and family preference, legislation, improvement in surgical and anaesthetic equipment and the advent of new drugs. We will recount the key enablers.

## HISTORY

Milne Barbour, President of the Royal Victoria Hospital, Belfast, at social events in 1940-1942, described the work of Robert Campbell and Andrew Fullerton. These accounts were of great interest to the surgeons of Harvard's 5th General Hospital, especially Thomas Lanman from Boston's Children's Hospital, stationed at Musgrave Park.<sup>1,2</sup>

Elected honorary assistant surgeon to the Belfast Hospital for Sick Children in 1897 and full surgeon one year later, Robert Campbell did much to reinstate the role of ambulatory surgery especially in the treatment of inguinal hernia. His results and commentaries as published in the British Medical Journal in 1899<sup>3</sup> and five years later in the Lancet<sup>4</sup> led to Nicoll's description of his outpatient surgical results in Glasgow in 1909.<sup>5,6</sup> Campbell's successor,

Andrew Fullerton, in 1913, reported to the Board of the hospital that in the previous fifteen years there "had never been a death following an operation in the extern department."<sup>7</sup>

In the 1950s and for the next thirty-five years, John Dundee and his co-workers, chiefly in Belfast, followed on the work of John Lundy of the Mayo Clinic<sup>8</sup> and Ralph Waters of the University of Wisconsin<sup>9</sup> in facilitating the introduction, and understanding of intravenously administered, short-acting anaesthetics.<sup>10,11</sup> Dundee, for intellectual and family reasons, often visited Boston and lectured at Harvard.

## BOSTON'S MISSED OPPORTUNITY

In 1919, Ralph Waters reported the successful experience of a downtown anaesthesia clinic in Sioux City, Iowa.<sup>9</sup> From Kansas City, where he described a free-standing outpatient surgical

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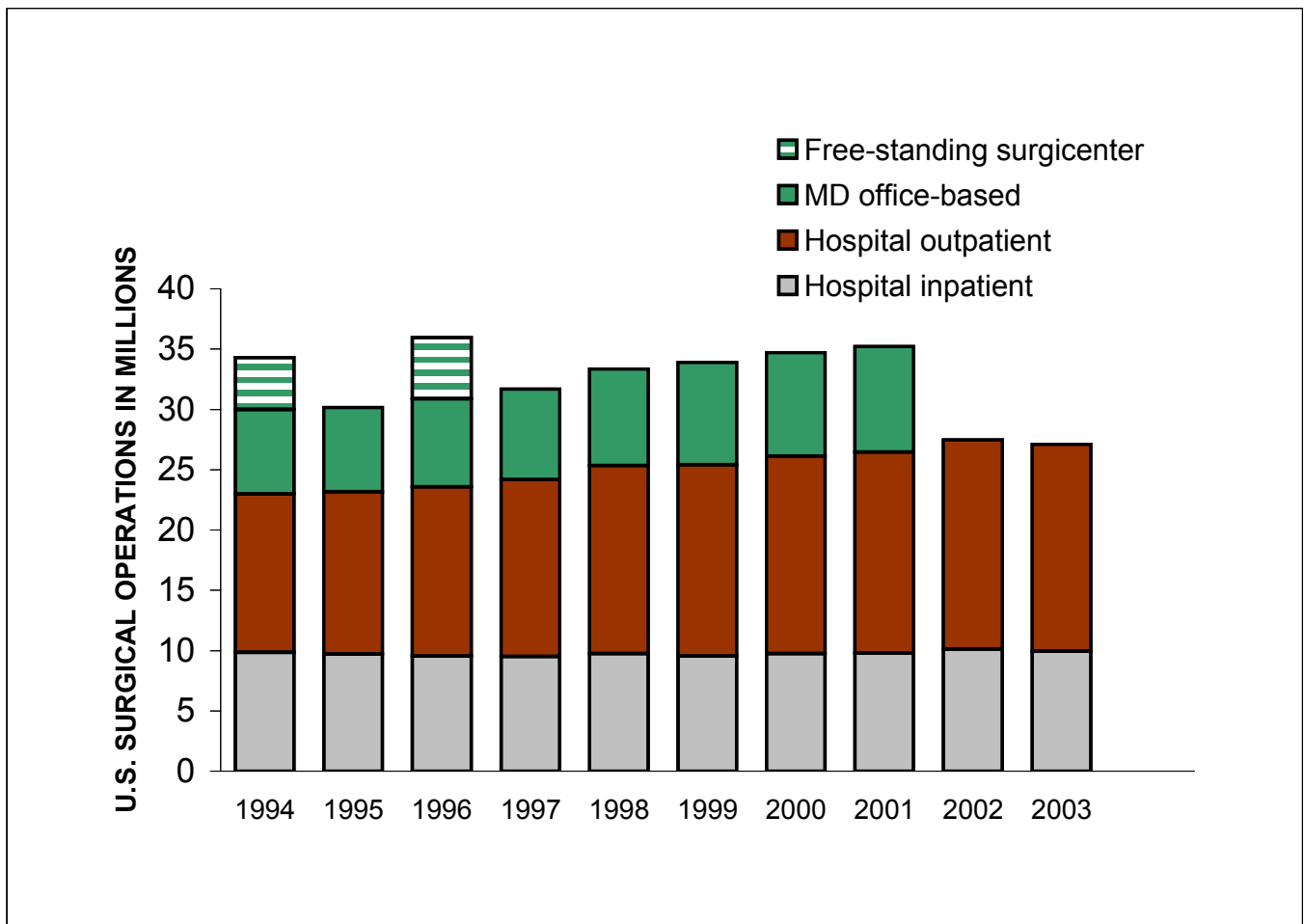
John Hedley-Whyte, MD, FACP, FRCA. (David S Sheridan Professor of Anaesthesia and Respiratory Therapy).

Debra R Milamed, MS, (Associate in Anaesthesia).

Harvard University, 1400 V.F.W. Parkway, Boston, MA 02132-4927 USA.

Correspondence to Prof Hedley-Whyte

email: john\_hedley-whyte@hms.harvard.edu



*Fig 1.* The total number of U.S. surgical operations has continuously increased. The rate of surgical procedures performed on hospital inpatients has slowly declined among the US resident population as this population has increased over the last decade. Hospital-based ambulatory surgery, MD office-based and free-standing surgicenter surgery continue to increase in volume. US Federal Statistics for surgicenter surgery only exist for 1994 and 1996; their collection will be resumed in 2006. In the US there are currently about 4,600 free-standing ambulatory surgicenters in operation, an increase of about fifty percent over the past five years. Almost nine million surgicenter operations (not represented in fig. 1) are projected for the US in 2005; the US federal figure was 5.1 million in 1996 (see “striped” data). Reliable data for MD-office based surgery are not yet available for the years after 2001.

service in 1923,<sup>12</sup> Waters was called to establish the first autonomous academic department of anaesthesia in a University at Madison, Wisconsin. This department was so successful that a Harvard Search Committee to fill the Henry Isaiah Dorr Chair in Anaesthesia Research called Waters to the Massachusetts General Hospital. While Professor Elliott Cutler,<sup>2</sup> Surgeon-in-Chief, Peter Bent Brigham Hospital, was showing Waters around, a chance encounter in the corridor with the in-situ Surgeon-in-Chief, Professor E (Pete) Churchill eventually led to Harry Beecher's appointment to the Dorr Chair.<sup>12</sup> Beecher was no champion of free-standing anaesthesia, and on more than one occasion threatened to fire a colleague who

was planning to moonlight on such an enterprise. Neither Beecher nor his department was interested in the development of short-acting anaesthetics. He did, sometimes, in his required departmental lectures, mention Morton's advice on outpatient anaesthesia.<sup>13</sup>

In 1966, Beecher asked John Hedley-Whyte if he would like to be nominated as a United States delegate to the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). At the Inaugural meeting of ISO Technical Committee 121 on Anaesthetic and Respiratory Equipment in London the shortcomings in performance and

lack of standardization were cataloged and a start made on writing performance standards for equipment used in anaesthesia, intensive therapy, ENT surgery and chest medicine. The US efforts had begun in 1956 with the formation of American National Standards Institute Committee Z79. The Z79 Committee, because of need for insurance coverage, metamorphosed by 1983 to American Society for Testing and Materials International (ASTM) Technical Committee F29 on Anesthetic and Respiratory Equipment. A similar committee for surgical instruments and equipment, ASTM Technical Committee F4, was founded in 1962, and continues its work today.<sup>14,15</sup> By October 1968, a disposable anaesthesia system and swivel Y-connector to the tracheal tube or facemask meeting ANSI Z79 and ISO TC121 specifications was in use for ambulatory surgery.

### THE HARVARD MEDICAL SCHOOL

In 1967, Hedley-Whyte became the second, to Beecher, tenured Harvard Anaesthesia Professor. He was moved from the Massachusetts General Hospital to Boston's Beth Israel Hospital by the President and Fellows of Harvard College, at least in part to help recovery from a scandal involving anaesthesia-associated brain death during childbirth (the fictionalized account by Barry Reed, *The Verdict*, and motion picture produced by Sidney Lumet, which starred Paul Newman, is almost entirely accurate).

Subsequently the father of the brain-dead mother threatened members of the anaesthesia department with retribution. His gun license was eventually revoked. In 1967, when Hedley-Whyte, during his visit to Musgrave Park and the Royal Victoria Hospital, Belfast, reported these events to John Dundee, he promised to help with physician recruitment. The result was that Hedley-Whyte was able to appoint four Ulster doctors as Director or Co-director of Clinical Anaesthesia, Outpatient Anaesthesia and Obstetric Anaesthesia: Dorothy M Crawford, Doris Cole, Nial M Murray and T Gordon McNabb. The first of the quartet subsequently married a surgeon expert in outpatient surgery,<sup>16</sup> the second an expert on transportation policy and the third, the Executive Assistant of Obstetrics.

In 1966, in planning the Harvard Anaesthesia Research Center Grant Proposal, Henrik Bendixen, the Principal Investigator, and co-investigators Myron Laver and John Hedley-Whyte, decided

that there must be an Engineering Unit for the Department of Anaesthesia of Harvard. This was funded by the National Institutes of Health at \$50,000 per annum for the period 1967-1972.

In 1969 Beecher was succeeded by Richard J Kitz as Dorr Professor and Head of Anaesthesia at the Massachusetts General Hospital. The Harvard Executive Committee on Anaesthesia started to hold regular meetings. The new committee and Harvard Department were to be patterned after the academic departments of Medicine and Surgery with a rotating presiding Secretary. Membership was to be limited to the professorial heads of hospital departments with separate approved anaesthesia residency training programs. Milton Alper (Children's Hospital), John Hedley-Whyte, Richard Kitz and Leroy Vandam (Peter Bent Brigham Hospital) were therefore the sole members. Kitz became Principal Investigator of the U.S. federally funded Harvard Anaesthesia Research Center, then in its second year, and Hedley-Whyte, Secretary of the Harvard Faculty of Medicine. The Committee met monthly for several hours and held retreats. "Each of us reported information that could be shared", wrote Kitz, and the problems of all aspects of the delivery of surgical care, intensive therapy, politics related to medicine, medical and surgical equipment, pain, insurance, economics, simulations and examinations were considered frequently, with outlines and handouts. According to Kitz,<sup>17</sup> "gossip was also a prime ingredient". Academically the committee and its appointed subcommittees functioned harmoniously and effectively. This organization was the genesis of monitoring guidelines, many equipment standards and the rediscovery of the patient safety concept initially promulgated by Codman in 1912 while working at the Massachusetts General Hospital.<sup>18</sup> The Executive Committee felt that the time had come to expand outpatient anaesthesia and surgery, whether hospital-based or at free-standing locations. This suggested the appointment of Ben Covino, an expert on local anaesthesia<sup>19</sup> to succeed Leroy Vandam. Covino had finished his residency at the Massachusetts General Hospital only two years before his call back to Harvard. Hedley-Whyte was subsequently appointed Chairman of a Harvard Medical Institutions Committee on Outpatient Surgery with Debra R Milamed as Secretary.<sup>20</sup> The election of two Harvard Faculty Members, Jess Weiss (1979) and Ellison C Pierce, Jr. (1984) as Presidents of the American Society

of Anesthesiologists, was a great facilitator for advances in patient safety, equipment standards and insurance and governmental negotiations.<sup>21</sup>

In 1972 Jeffrey Cooper was recruited by Dick Kitz to assume control of the Harvard Bioengineering Research Unit. The evolution of this Bioengineering Unit has been called the DNA of the Patient Safety Movement;<sup>17</sup> if so, International Standards writing must be the RNA. Since 1966 the interchange of information between the US and British and other national standards writing bodies, International Organization for Standardization (ISO) Committee ISO TC121 on Anaesthetic and Respiratory Equipment and the International Electrotechnical Commission (IEC) Technical Committee 62 on Electrical Equipment in Medical Practice, has been invaluable for evaluation of medical equipment used in both inpatient<sup>22</sup> and outpatient surgery.<sup>16</sup> As a result equipment standards for both inpatient and outpatient surgery are now the same.<sup>23,24</sup> The development of the US Food and Drug Administration (FDA) and the German Bundesinstitut für Arzneimittel und Medizinprodukte (BfArM) medical equipment function data bases and the engineering skill of Harvard and the Massachusetts Institute of Technology (MIT) provided, starting in the early 1970s, very beneficial feed-back and cross-fertilization of equipment design and both pre- and post-market assessment of devices.<sup>20,24</sup>

About 1973 it became obvious that there needed to be both a code of conduct for anaesthesia and its monitoring and a set of performance-based international standards for life support equipment involving most equipment used in anaesthesia and critical therapy.<sup>21,25</sup> Meanwhile under Cooper's leadership there was a revival of critical incident analysis.<sup>26</sup> Such work received support from both the insurance and aeronautics industries. The US FDA lead on the anaesthetics committees was Pete Carstensen, an aeronautics engineer, and his input was seminal in advising John Eichhorn and his subcommittee of the Executive Committee that developed the Harvard Monitoring Standards for Anaesthesia.<sup>27</sup>

The Massachusetts General Hospital opened its Surgical Day Care Unit in 1974, and the other Harvard hospitals soon followed. The major reimbursement for medical care at the Massachusetts General Hospital was from Blue Cross/Blue Shield

of Massachusetts. This insurer refused to pay for surgical or anaesthetic professional services unless the patient was admitted to hospital. After numerous visits of teams of administrators, surgeons, and anaesthesiologists, this insurance carrier agreed to reimburse the hospital for outpatient surgical and anaesthesia care on a trial basis.<sup>28</sup> The Harvard experience with insurance payments thus mirrored the Phoenix experience, but five years later.

## PHOENIX, ARIZONA

In 1970 the Phoenix Ambulatory Surgicenter opened as a free-standing ambulatory unit.<sup>29</sup> Preliminary planning with 101 insurance companies, the project architect, representatives of the local hospital and community and with the Arizona State Legislature and the state's executive governor were initiated in 1968 and took almost two years to be successful. The Phoenix Surgicenter's records of these negotiations, their fiscal reports and their careful surveys of patient and health care provider feedback were of inestimable value in alleviating the worries of hospital staffs, trustees and politicians in subsequent negotiations at other sites worldwide.<sup>29,30</sup> These worries were substantial because revenue loss to hospitals was considerable, often in the order of thirty percent of hospital gross. All was not smooth sailing. In 1971, C Rollins Hanlon, Director of the American College of Surgeons discussing the recent Duke University experience noted that the Phoenix Surgicenter had not been approved for reimbursement under Part A of Medicare. The reason free-standing surgical facilities had not been approved by the National Blue Cross Plan was because of a \$60 million deficit in their Federal Employees Program to cover surgery without hospitalization. This deficit was allegedly due to overordering of outpatient perioperative laboratory tests and radiographs. The move from inpatient to outpatient surgery for Federal employees had not saved money. Hanlon continued, "In Phoenix the controversy is submerged, whereas... in Providence, Rhode Island the facility has not been accepted by "the profession" nor by local Blue Cross". Further speakers referred to the need for inspection and accreditation and for standards for surgery and anaesthesia to be equivalent to those required in hospitals accredited by the US Joint Commission on the Accreditation of Hospitals, now the Joint Commission on the Accreditation of Health Care Organizations.<sup>31</sup>



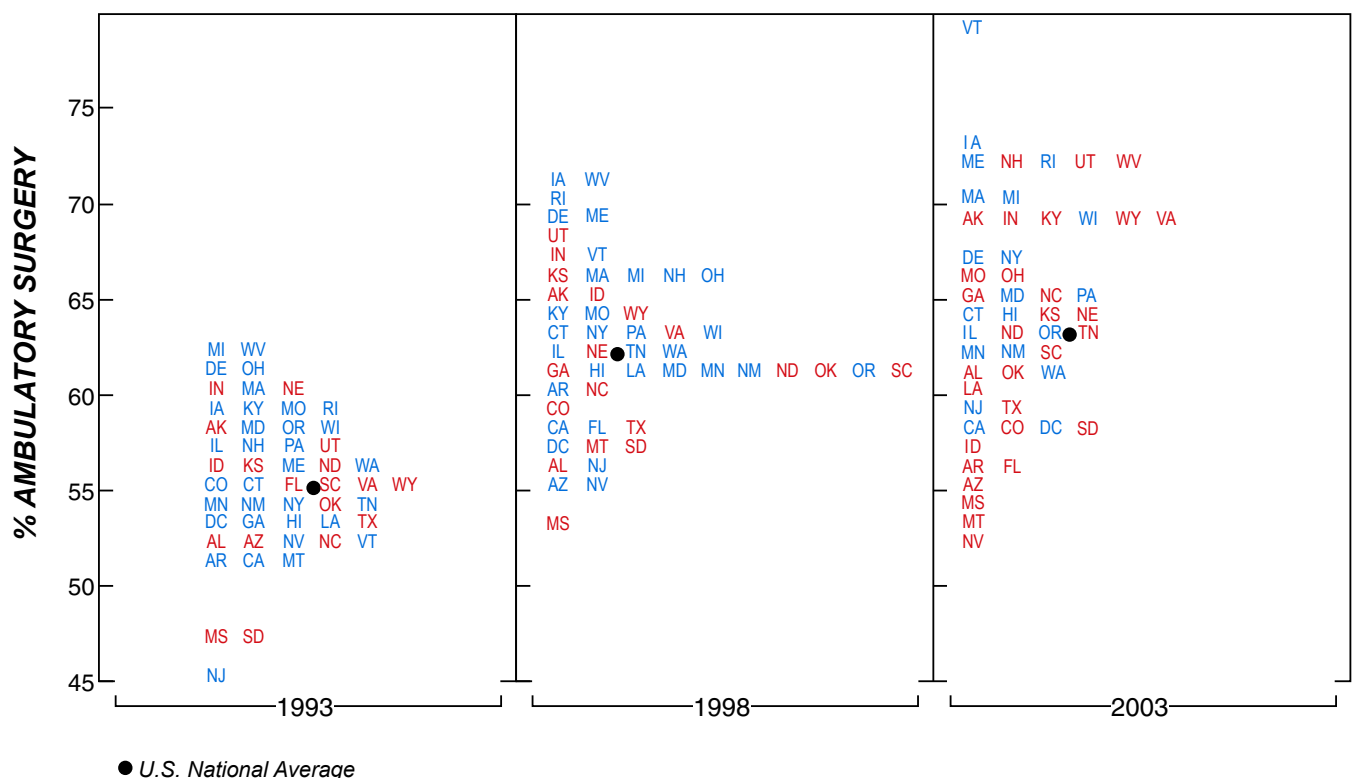
## WASHINGTON, DC, LOS ANGELES AND CANADA

The Department of Surgery/Anesthesiology at the University of California at Los Angeles reported on their experience from 1962 in a “properly equipped and staffed outpatient surgical unit”; the conclusion was that there were cost savings and safety.<sup>32</sup> Insurance companies frequently would not reimburse because the relevant policy required admission to hospital for at least 18 hours.<sup>32</sup> In 1967, the first year of “in and out” surgery at George Washington University in Washington DC was reported to the US Southern Medical Association.<sup>33</sup> The patients approved, despite 73 percent reporting postoperative nausea and 40 percent headache. Nausea, vomiting and sore throat were common, occurring in approximately a quarter of outpatient surgical patients, but only one in fifty required admission to hospital.<sup>33,34</sup> During the same period, the conduct of one surgical and two dental outpatient operating rooms in the city of Vancouver, British Columbia was described.<sup>35</sup>

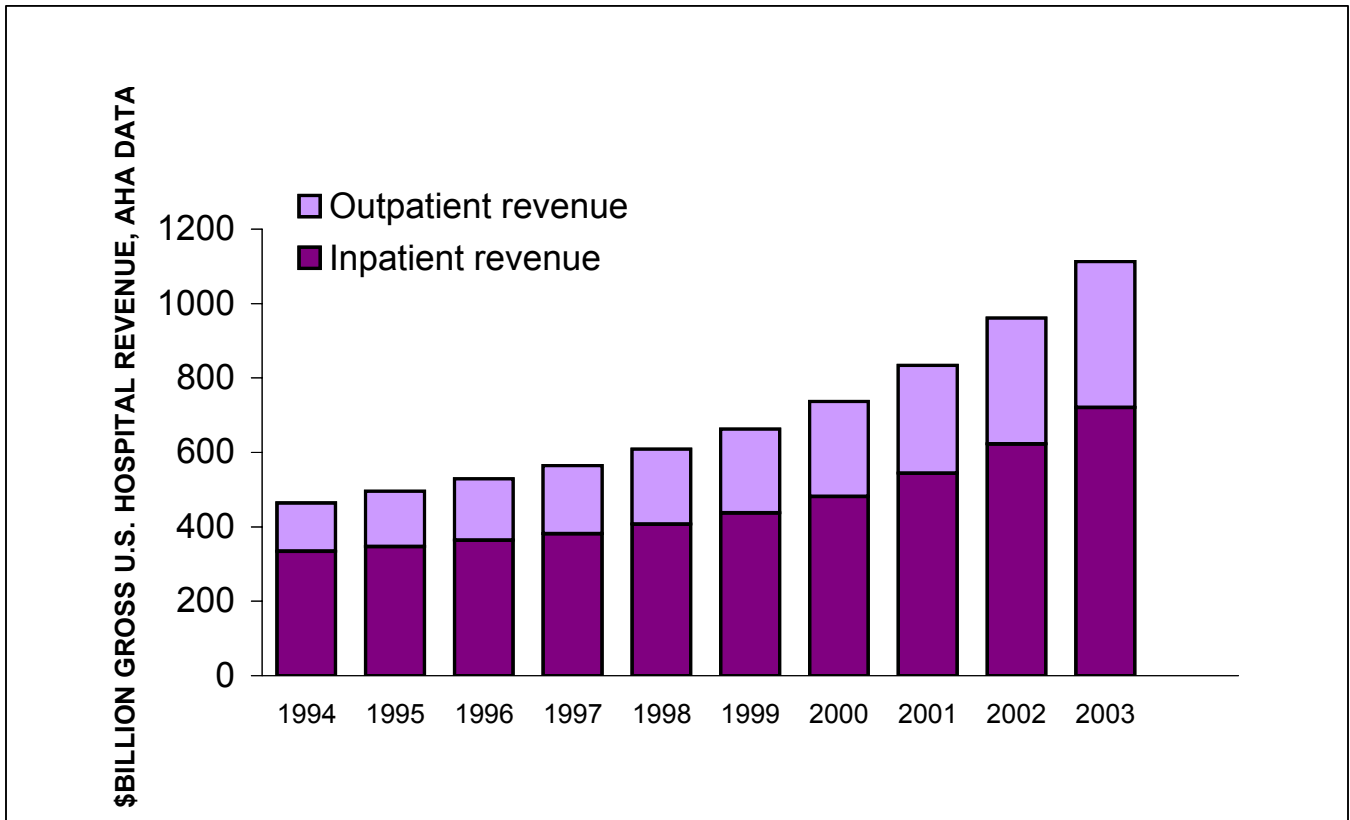
## US FOLLOW-UP THIRTY AND FORTY YEARS ON

The US Health Care Financing Administration (HCFA), has established standards for ambulatory surgical services for Medicare and Medicaid patients.<sup>36</sup> The designation of specific procedures as appropriate for outpatient status does not preclude government coverage in an inpatient hospital setting, usually the preferred location for procedures requiring operating time and/or general anaesthesia of 90 minutes or more and four or more hours of recovery.<sup>36</sup>

The Joint Commission on Accreditation of Health Care Organizations (JCAHO)<sup>37</sup> and the American Association for Accreditation of Ambulatory Surgery Facilities<sup>38</sup> accredit sites where ambulatory surgery is performed and review personnel. Both organizations reappraise staff annually or biannually.<sup>37,38</sup> The American College of Surgeons’ *Guidelines for Optimal Ambulatory Surgical Care and Office-based Surgery* includes all aspects of ambulatory surgical care,<sup>39</sup> and has been cross-



**Fig 2.** The different states of the United States differ considerably in the proportion of surgery performed without admission to hospital. These figures provided by the American Hospital Association include only hospital-based surgery. Free-standing surgicenter and MD office-based surgery are excluded (see fig. 1). The differences between states may reflect different state laws and regulations, county and other local ordinances, as well as demographic factors and variations in physician practice patterns. US presidential electoral voting results for each state are indicated as red for Republican candidates and blue for Democratic Party candidates. The 1993 panel is mapped to the 1992 presidential election (GHW Bush versus WJ Clinton), the 1998 to the 1996 election (WJ Clinton versus R Dole) and the 2003 to the presidential election of 2000 (A Gore versus GW Bush). There appears to be no association between a state’s political orientation and the percentage of surgery performed without admission to hospital.



**Fig 3.** According to the American Hospital Association over the decade from 1994 through 2003, the gross revenue of US acute care hospitals increased from approximately 450 billion dollars to just over one trillion, or doubled in the first nine years using constant dollars. During this decade, US Gross Domestic Product (GDP) increased 32% in constant dollars. Outpatient revenue as a percentage of total gross hospital revenue has shown a small but steady increase (28–35%) during the same decade.

referenced by the JCAHO to its accreditation requirements.

The American Society of Anesthesiologists has approved guidelines for office-based anaesthesia, standards for basic anaesthetic monitoring, pre- and post-anaesthesia care and guidelines for ambulatory anaesthesia and surgery, as well as non-operating room anaesthetizing locations.<sup>40</sup> If exceptions are made to these standards and guidelines, the reasoned justification shall be documented in writing.<sup>40</sup> The American Association of Nurse Anesthetists has developed standards for Certified Registered Nurse Anesthetists (CRNAs) which address responsibilities in perioperative care.<sup>41</sup> The Anesthesia Patient Safety Foundation has promulgated twenty-two questions to ask before accepting office-based anaesthesia.<sup>42</sup>

Recently the US Department of Health and Human Services, Centers for Medicare and Medicaid Services has issued an “Update of Ambulatory Surgical Center List of Covered Procedures: Interim

Final Rule.”<sup>36</sup> While it may be a reasonable list for 2005, it may hinder advances in endoscopic surgery and in hip and knee replacement. The US Federal government has agreed to reinstitute its information gathering of 1994 through 1996 on ambulatory surgery, beginning again in 2006.

The acceptance internationally of the Harvard anaesthesia monitoring guidelines<sup>27</sup> has been guided by their success in reducing complications and lessening the cost to insurance carriers for surgeons and anaesthesiologists.<sup>43</sup> Most carriers now are reluctant to insure physicians who do not follow relevant guidelines and standards.<sup>43</sup>

Variations in results for individual institutions with differing practices may be hidden in national statistics and important local changes may be obscured.<sup>44–49</sup> Certainly it is not immediately apparent why the rate of outpatient surgery is so different between countries and states<sup>45,47</sup> (Fig 2).

The number of free-standing ambulatory surgery centers in the US had increased to over 3,700 by

2004,<sup>45</sup> and according to the New York Times of June 14, 2005, about 4,600 by mid-2005. These surgicenters are neither physically nor financially connected to hospitals and are generally physician-owned. Claims and settlements for anaesthetic malpractice have recently shown a marked decrease. This trend supports the surveys of outpatient surgical patients, which show appreciation. Less than one percent of patients undergoing ambulatory or office-based surgery require hospitalization.

Hospital revenues, at least in the US seem to have compensated for the loss of revenue caused by the shift to ambulatory surgery (Fig 3).<sup>45,50,51</sup>

### POLITICS AND FINANCE

In the United States the pressure to change from inpatient to outpatient surgery appears to have come largely from patients and the more entrepreneurial members of the medical profession. This change was impeded and delayed, at least in the earlier stages, by insurance companies' financial restrictions and concern about safety. In the United Kingdom, the pressure was from the British government to reduce the requirement for surgical beds and thereby save expenditure. Much of the rest of the world has yet to make this change.

What is striking about this change in the United States is how hospital revenue has been compensated for the loss of hospital-based surgery (Figure 3). Surgical revenue is approximately five percent of the US Gross Domestic Product (GDP), so hospitals were losing three percent of US GDP. The sporadic, but often vehement and legalistic, opposition of local hospital trustees and state government to the setting up of free-standing surgicenters is thus understandable but misplaced.

Are patients overall receiving value for money? The advances in medical equipment safety and cost have been enormous in the last forty years.<sup>52-54</sup> Even the principal author of former President Clinton's proposed health plan, Harvard's Otto Eckstein Professor of Applied Economics, David Cutler, thinks the benefits of medicine are worth what is now paid. As a participant in the Harvard University Technology Assessment Group and present Dean of Social Sciences, his is an interesting epiphany.<sup>55</sup>

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